

Functional Area 1 - Research and Development (R&D)

PSI Contract N00167-96-D-0010, DO 81, 88: The Naval Surface Warfare Center, Carderock Division (NSWCCD) has the responsibility for submarine acoustic signature measurement and characterization. As part of this responsibility, NSWCCD performs radiated noise measurement trials on US submarines. In the process of performing these trials on a new submarine class, NSWCCD radiated noise analysts found unexpected broadband noise in several frequency bands. PSI performed R&D Support in the area of Ships and Ship Systems to assist NSWCCD analysts determine the source of this noise. This effort required fundamental research into the nature of the noise to be localized, possible noise mechanisms, and into source localization techniques. PSI then analyzed and documented the requirements for a noise localization capability that would address these mechanisms. In this investigation, PSI developed a new localization technique that used the existing measurement assets. This method uses long baseline interferometry to localize noise sources along the submarine hull. This technique requires the submarine and measurement assets to operate in new ways, so PSI developed a new operating concept for the existing measurement system and the submarine being measured. Once the initial research was complete, PSI performed system development for a data acquisition and processing system to implement the concept. PSI supported at-sea testing and then supported continued development of the processing, analysis, and display to develop a new capability that extended the state-of-the-art in submarine noise source localization. The algorithms and capabilities developed in this R&D program are now being transitioned into an operational system by PSI, demonstrating not only the utility of our research efforts, but also our System Engineering and Software Engineering capabilities.

APS Contract N00014-03-C-0169: APS planned and conducted a series of tests of a motor and pump system at NSWCCD Code 99 facilities in Philadelphia to evaluate how sources of acoustic excitation with a motor propagate to remote locations in dynamically complex piping systems. Evaluated noise control features and influence of the performance of electrical power systems. The work was performed in collaboration with Knowles Atomic Power Laboratory (KAPL), and NSWCCD Codes 99 and Code 70 and made extensive use of accelerometer, hydrophone, and microphone arrays. Conducted analytic studies of structural mode scattering of the motor. Array processing and equations of motion were employed to assess the partitioning of acoustic power between the structure and fluid, and between wave type propagating in the piping. Arrays were also used to decompose the motor response. Assessments of the impact of electrical power conditioning were conducted. KAPL noted that the work provided an excellent and novel evaluation of motor and pump excitation and response mechanisms. Also developing motor performance scaling relationships in collaboration NSWCCD Codes 70 and 99, and KAPL. Conducted detailed evaluations of small scale surface ship model hull response and radiation in collaboration with NSWCCD Code 70. Developed analytic models of fluid loaded hull structure. Developing analytic and numerical models of a new

innovative propulsion concept and assessing noise mitigation concepts, radiation and noise transmission mechanisms, and performance drivers. Analytic, transmission line, and finite element modeling techniques are being employed to assess the acoustic performance and underlying performance drivers of the concept. The interaction of the motor, propulsor and related structures and fluid is being evaluated.

PSI Contract DAAB15-00-C-1009: Following a lengthy R&D development effort to formulate the concept, PSI built a Ground Penetrating Synthetic Aperture Radar (GPSAR) system for the U.S. Army Night Vision and Electronic Sensors Directorate under a Phase III SBIR award. PSI engineers designed, built, and outfitted a remotely-controlled electric cart for GPSAR electronics, radar transmit and receive arrays, and image processing and display computer systems. PSI software engineers also developed custom software for real-time image processing and display. The software displays a scrolling subsurface image as the cart moves forward. Unlike other ground penetrating radars, PSI's system advanced the state of the art, using near-field beamforming to image buried objects in three dimensions. The GPSAR is optimized for anti-tank mine detection and operates over a frequency band of 500 MHz to 1.8 GHz. Fourteen transmit and 14 receive antennas are configured to acquire stepped frequency data at 26 cross-track focal locations. PSI scientists and engineers tested the GPSAR on the outdoor Subsurface Imaging Test Bed located at PSI's Engineering Center in Long Beach, MS. The Test Bed contains surveyed landmine and landmine simulates buried at various depths. PSI also tested the system on the practice mine lanes at Ft. A.P. Hill, VA., and Yuma Proving Ground, Yuma, AZ.

AAC Contract N00024-02-C-6311: AAC performed a wide range of analyses for the Surface CAUSS Functional Segment, which provides sonobuoy processing improvements to existing LAMPS processing. AAC performed concept formulation for this common acoustic processor, requirements analyses, development, and the development of operational concepts. The goal and end-product of this effort was a new and more flexible common acoustic processor for fleet use. The Surface CAUSS Functional segment was integrated into AN/SQQ89 through the Integrated PRP (Peer Review Process) System (IPS). The objective of the IPS initiative is the rapid fleet deployment of technology innovations, combining the Peer Review Process (PRP) based sea test approach with accelerated ship installations. The R&D performed for Surface CAUSS Functional Segment was deemed to be of sufficient interest that it was selected for accelerated sea testing under this approach.

Additional Contracts:

APS Contract N00014-01-C-0441, Contact S. Schreppler 703-588-2361

ASTM Contract DE-AC01-03NE23744, Contact Lesica Sue, 301/903-8755

NTI Contract N00167-01-D-0016, Contact Dr. P. Shang, 301-227-1559

AHA Contract N00039-97-C-0031, Contact Loretta Bourne - 619-524-7154

AHA Contract N00024-96-C-6231, Contact Richelle Sweeney-703-885-7765